PowerPlant Chemistry® **The Journal of All Power Plant Chemistry Areas**

International Edition **ISSN 1438-5325 October** **Volume 9 (2007), No. 10**

Abstracts

Condensation of Flowing Steam with Nucleation in the Salt Solution Zone

Miroslav Šťastný and Miroslav Šejna

The effects of chemistry on nucleation in flowing steam are particularly unclear. An approach is used in the paper which is based on binary nucleation of the main impurity, NaCl, and water. Physical and mathematical models are described and applied on the steam flow with condensation in a convergent-divergent nozzle. A binary nucleation numerical model is applied for the calculation of the flow with condensation in the nozzle, with an expansion rate in the divergent nozzle part of $\dot{\bar{P}}$ = 4 500 s^{-1}. The flow in the nozzle is smooth and it is possible to observe only a small delay in the pressure and a small temperature shock downstream of the nozzle throat.

PowerPlant Chemistry 2007, 9 (10)

Oxyanion Inhibition of Passivity Breakdown and the Nucleation of Pits on Type 316L Stainless Steel

Digby D. Macdonald and Shoufeng Yang

Passivity breakdown of Type 316L SS (UNS S31603) in the presence of aggressive $Cl^-$and inhibitive NO_3^- anions has been experimentally studied and the results have been interpreted in terms of the point defect model (PDM). By expanding the PDM to include competitive adsorption of Cl^- and NO_3^- into surface oxygen vacancies at the passive film/solution interface, the critical breakdown potential, V_c, has been predicted to vary linearly with log [Cl^-] and with log ([Cl^-]/[NO_3^-]), which is found experimentally. The slope of V_c vs. log [Cl^-] is found to be unaffected by NO_3^-, thereby yielding the same values for the polarizability of the film/solution interface, regardless of the nitrate concentration. The critical breakdown potential increases weakly with increasing nitrate concentration at low [NO_3^-] but, at a concentration of 0.06 M, V_c increases sharply and pitting attack is no longer observed. The viability of the PDM for accounting for passivity breakdown on Type 316 SS is explored by measuring the voltage scan rate dependence of the critical breakdown potential, from which the critical areal (two-dimensional) concentration of condensed vacancies at the metal/barrier layer interface can be derived. Good agreement between the value obtained from experiment and those calculated from structural arguments demonstrate the validity of the PDM.

PowerPlant Chemistry 2007, 9 (10)

Is Cation Conductivity Monitoring Relevant For Today's Combined Cycle Power Plant? – Yet Another Case Study Says It Is Not

Luis Carvalho, Thomas James, and William E. Hunter

Cation (or acid) conductivity is the main control parameter in the cycle chemistry of many combined-cycle power plants today. However, hundreds of these systems consistently fail to achieve cation conductivity values that are required to meet the strict steam turbine original equipment manufacturer (OEM) specifications.

This paper describes the cycle history of a combined cycle cogeneration plant in the U.S. Southwest and relates it to plant asset integrity. Commissioned in the late 1980s, this 120 MW (1x1x1, combined cycle, GE 7EA x Zurn HRSG x GE steam turbine) plant was designed for and operated in base-load mode for 15 years before converting to two-shift cycling approximately two years ago. Plant records show that during its entire operating life, cation conductivity readings throughout the cycle (condensate, feedwater, steam) ranged between 2–5 $\mu S \cdot cm^{-1}$. This is more than an order of magnitude higher than the maximum allowable values in recent turbine OEM specifications. Organic matter and other contaminants also consistently exceeded recommended industry guidelines. However, several major turbine inspections reveal a turbine in excellent condition. In more than 17 years of plant operating life, past problems have been limited to a few expansion-related failures in the feedwater economizer and high-pressure superheater drain during the first year of operation.

The paper describes other key cycle chemistry data, including internal treatment and condensate treatment regimes, and proposes alternative monitoring techniques to cation conductivity.

PowerPlant Chemistry 2007, 9 (10)

Assessment of the State of the Art of Sampling of Corrosion Products from Water/Steam Cycles

Piti Srisukvatananan, Derek H. Lister, Robert Svoboda, and Karol Daucik

A properly designed sampling system and a suitable sampling procedure are required to obtain representative samples from water/steam cycles and general coolant water systems in power plants because operating decisions often rely on water chemistry information. Several factors must be taken into consideration, such as material selection, system design, proper procedures to maintain the integrity of the sample prior to analysis, etc. This report reviews and summarizes key points and sampling problems experienced in real situations. Theoretical considerations are discussed to some extent to provide more comprehensive views of phenomena in sampling systems. Also, based on available literature, the report briefly explains sampling techniques and studies pertinent to operating power plants.

PowerPlant Chemistry 2007, 9 (10)

Condenser Tube Failures in Water-Cooled Condensers with Stainless Steel and Titanium Tubes

Albert Bursik and Hans-Günter Seipp

Integrity of the condenser is one of the most important prerequisites for optimum availability, reliability and performance of fossil and nuclear units. Recently, generic 300 Series stainless steels, proprietary austenitic and ferritic stainless steels, and titanium seem to have completely displaced the traditional copper-based alloys. After publishing a paper dealing with condenser tube failures in water-cooled condensers with copper-based alloys in the last journal issue, this contribution focuses on operation experience and the most important types of tube failures encountered in stainless steel and titanium condenser tubing.

PowerPlant Chemistry 2007, 9 (10)